SCIENCE

VOL. LXVII JANUARY 6, 1928 No. 1723

CONTENTS

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal.

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 8, 1879.

STATURE THROUGHOUT THE WORLD[1]

A GENERAL survey of stature has been started in connection with a study of old Americans in Virginia and this report is a condensed summary of the preliminary work. Only males are considered.

Stature is a complex dependent upon the growth of various parts of the body, chiefly bone and cartilage. This growth is partly regulated by the endocrines of the hypophysis and thyroid, and it is influenced by a great number of factors, such as food, water, habit and habitat. It is impossible to measure each factor that enters into the life history of each individual, therefore mass statistics are used, and only general results and conclusions may be given.

The records have been obtained from various sources, and many of them are of men below the age of 25 years who therefore had not finished their growth. In general there is no distinction as to age; all ages are included, from near adult to the old, although the majority are between the ages of 20 and 30 years. The technique of measuring is not always the same in gathering the records, therefore they may not all be fairly comparable. The method of grouping them by the median of group means or averages should prevent any gross errors as the result of technique or the selection of individuals.

Group medians are used throughout because this affords the fairest average stature. There are 326 groups from Europe and the median of the group averages is 169.4 centimeters. The extremes are one group of "Indigent French" with a stature of 156.0 centimeters, and one group of "Scotch Farmers" with a stature of 181.2 centimeters. There are two distinct modes, one at 166.0 centimeters and the other at 170.0 centimeters. This is clearly indicated by the median for southern Europe at 165.5 centimeters, and that for northern Europe at 170.6 centimeters, with middle Europe at 166.6 centimeters.

The median of 135 groups in Asia is 161.1 centimeters, with extremes of one group of Negritos from southern India at 148.0 centimeters, and one group of Ainos with a stature of 172.0 centimeters. Persians and Turks are not included in Asia but are put

[1] Address of the vice-president and chairman of Section H—Anthropology, American Association for the Advancement of Science, Nashville, December, 1927.

with Europe. There are three groups of these at 165.0, 173.0 and 175.0 centimeters. The Asiatics, except for the Negritos, are more homogeneous than the Europeans, if we leave out the Persians and Turks, although the Ainos should also be excluded because they are modified Europeans. Under such circumstances the extremes for Asia would be one group of Malays with a stature of 154.0 centimeters, and one group of Tibetans with a stature of 162.5 centimeters. The stature increases from Asia to Europe through the Persians with a stature of 166.0 centimeters and the Turks with a stature of 168.0 to 175.0 centimeters.

The median of 245 groups in Africa is 170.0 centimeters, with extremes of one group of Negrillos with a stature of 130.0 centimeters, and one group of Somalis with a stature of 180.3 centimeters. The spread of the curve is greater for Africa than for Europe, and it is skew for tall stature, trailing in the low. This would show that there are more negroid stocks in Africa than true Negroes and Negrillos, who are not so tall as the negroid stocks.

The median of 126 groups of North American Indians is 165.0 centimeters, and extremes of one group of "Partial Albino" Central American Indians with a stature of 145.7 centimeters, and one group of the Winnipeg Indians with a stature of 180.0 centimeters. The curve is irregular with three distinct nodes at 156.3, 163.8 and 173.8 centimeters.

The median of 38 groups of South American Indians is 160.0 centimeters with extremes of one group of Aymaras with a stature of 148.0 centimeters and one group of Patagonians with a stature of 185.0 centimeters.

The median stature of 152 groups from the Pacific Islands is 159.0 centimeters, with extremes of one group of Negritos with a stature of 139.7 centimeters and one group of Australians with a stature of 185.0 centimeters. The curve has a mode at 160.0 centimeters and a submode at 170.0 centimeters.

The tall statures of the Patagonians, Australians and Somalis may have been the result of the selection of extremely tall persons to be measured. This seems to have been the case with the Patagonians, especially, because several groups had statures from 171 to 175 centimeters.

EUROPE

Stature in Europe has its summit in Scandinavia of 172.5 centimeters, with Great Britain a close second at 171.0 centimeters, and Denmark, Germany and Turkey following with about 170.0 centimeters. Some may object to putting Turkey and Persia in Europe, but their similarity in many physical characters and their similarity of stock and origin have led me to do this. Low stature has its extreme at 155.0 and 157.5 centimeters among the Lapps and northern Russians, who might well be put with Asia. The Italians and Jews come next with a stature of 164.0 centimeters followed by the Russians and French at about 165.0 centimeters. Central Europe, which includes Belgium, Switzerland, and the Balkans, has a stature of 167.0 centimeters, and Greece has about the same.

It may be said that in general stature in Europe is low in the north as among the Lapps and northern Russians, and low in the south as among the Italians and Jews, and it is higher in between. The Scotch have the highest individual statures, it is high in England, and higher in the United States, especially among the Old Americans of British origin. There is evidence of two areas of high stature in Europe, the one in Scandinavia, North Germany and the British Isles, the other about the interior littoral of the Atlantic and Mediterranean. The former are called the Nordic or Teutonic Peoples, and the latter are called the Littoral, Adriatic and Dinaric Peoples. There is also evidence of two areas of small stature the one toward the Arctic zone and the other toward the Tropics. The restless activity by the cold, moist, cloudy Baltic region, or the steppe and mountain, had some influence in molding the tall stature, whereas the extreme cold of the far north and the heat of the Mediterranean with civilization had some influence in making the stature small. Through these influences selection acted, and heredity carried on the result.

There are pockets of high and low stature in Europe and in the other continents, as demonstrated by Wissler for the American Indian. These "patches" may be the centers of radiation for the culture, or centers of compression by the tribes from without. Ripley presents evidences of the crazy quilt effect of stature distribution in Europe, and discusses at some length the effects of race and environment. He gives the results of "misery spots," "artificial selection," "natural emigrants," "occupation or professions," and the "habits of life or of the nature of employment." These all have their influence in a minor way. Visualizing the whole continent brings out major influences. It is only by getting out of the woods that the forest may be seen.

ASIA

The summit of stature is found in China, 162.0 centimeters, India 164.0 centimeters and Tibet, 162.5 centimeters: and the lowest stature is found among the Negritos, 148.0 centimeters, and in the Malay

peninsula, 154.0 centimeters. The Mongolians and Siberians in the north have about the same stature as the Indo-Chinese and southern Indians in the south, 159.0 centimeters. Tall statures are found about the high plateaus of western Asia and this is less in the north and south as well as in Japan, and in the latter the stature is also about 159.0 centimeters. The stature changes from 164.0 in northern India to 157.5 in southern India and 148.0 among the Negritos of southern India and the Malay peninsula. The Malays are closer to the Negritos in stature than any other people and the Indo-Chinese are closer to the Malays. These relations become more distinct when the peoples of the Pacific Islands are studied.

Pacific Islands

The summit of stature in the Pacific Islands is reached in certain groups of Polynesians where it is 172.0 centimeters, and the extreme of low stature among the Negritos where it is as low as 139.7 centimeters. A few small groups of individuals among the Australians have a stature of 185.0 centimeters. The stature of all the groups of Malays is 159.0 centimeters and that of the Senoi or Sakai is 152.5, whereas the stature of the Negritos nearby is 148.0 centimeters. The Senoi or Sakai are so manifestly crosses between the Malays and Negritos that their stature is easily explicable. There are two distinct types among the Polynesians, the European and the Malay, and there are two distinct groups of stature, the one at 161.0 centimeters and the other at 172.0 centimeters, with no intervening groups between 165.0 and 170.0 centimeters. The stature of the Melanesians is 161.5 centimeters and the stature of the Australians is 167.0 centimeters. The latter shows the European influence through the "Hairy Men." Groups of hairy men are found in a broad zone from Russia to Australia, with remnants in Japan and the Philippines.

There is tall stature in Asia about the great plateaus bordering on Persia and Turkey, and small stature toward the Arctic and Tropic zones, with smaller statures in the Pacific Islands among the Negritos and Malays. The Malays are mixtures of the Asiatic, Negrito and European. There is tall stature among the Polynesians and Australians, with less tall stature among the Melanesians. The Polynesians are mixtures of the Europeans, Malays and Melanesians with more European than other stocks, and the Australians are mixtures of the Melanesians, Malays and Europeans with more of the Negroid than other stocks. In Australia there is apparently a tall negro element different from the Negrito. This, however, may be more apparent than real.

Africa

The summit of stature in Africa is found among the Bantus of eastern Africa, along the upper Nile region and among the great lakes, as well as in North Africa, where the group average of 185 centimeters is not uncommon and in one group of Somalis the stature is 185.3 centimeters. Low stature has its extreme among the Negrillos and Bushmen, with a low of 130.0 centimeters for the former and of 142.5 centimeters for the latter. The median for 102 groups of North Africa and 48 groups of East Africa is 171.0 centimeters which is the same as that of the Bantus. The median for 21 groups of Negrillos is 147.5 centimeters. Between the extremes of high and low stature are the Bushmen, 156.0, True Negroes 161.0, Berbers 164.0, and Bantus mixed with True Negroes 166.5 centimeters. If one approach the Negrillos from any side there is a gradual transition from a high to a low stature and other changes accompany this, from the True Negro on the west, the Bantu on the east, the Hottentot and Bushman on the south, and the Europeanized Hamitic and Semitic Negroid on the north.

Tall stocks have been coming into Africa from Asia and Europe throughout historic time and probably before, and these stocks have mixed with the Negroes to produce the tall peoples of Africa. The tropic conditions in central Africa have dwarfed the True Negro into the Negrillo, and the True Negro has also become dwarfed.

North America

North America is divided into five parts, Eskimo, Canada, United States, Mexico and Central America. There is a gradual increase in stature from the Eskimos through Canada to the United States, and a sudden decrease through Mexico to Central America. The summit of stature is reached among the Winnipeg Indians of Canada, 180.2 centimeters, and the Dakotas, 178.0 centimeters, and Apaches, 176.2 centimeters, in the United States. Low stature has its extreme among the San Blas Indians of South America. Starr gives the stature of 2,276 Mexican and Central American Indians as 157.5 centimeters. The low stature towards the arctic and tropic zones in North America indicates as elsewhere that those zones do not favor tall stature.

South America

Stature in South America has its summit in Patagonia, where several groups attain the stature of 185.0 centimeters. Other groups of Patagonians average between 171.0 and 175.0 centimeters. Probably tall members of the tribe were measured in the

groups with statures of 185.0 centimeters. Low stature has its extreme among the Aymaras, Quechuas and Machigangas of the interior tropic zone and among the Fuegians at the southern extremity of South America towards the arctic zone. We have something similar to this condition in Africa in the low stature of the Negrillo in the jungles, high stature in the southeast, and low stature in the south among isolated groups of Bushmen and Hottentots. Steppes, pampas and fertile regions in temperate zones produce high statures. Jungle and infertile cold regions produce low statures. This is but an expression of the fittest for each region, who survive.

OLD AMERICAN WHITES OF VIRGINIA

For the past few years I have been making a study of the Old Americans in Virginia, and in this study have measured several thousand men, women and children from Tidewater, Piedmont and Mountain sections of the state. There is a difference in the stature of the Tidewater section on the one hand and the Piedmont and Mountain sections on the other. The stature from all three sections is 173.7 centimeters. The tallest group is that of the leading farmers of Albemarle County in the Piedmont section of the state where the stature is 176.2 centimeters with extremes of 165.1 and 190.4 centimeters, and the smallest group is from Tidewater where the stature is 170.7 centimeters with extremes of 160.6 and 181.6 centimeters.

The tall stature in the Piedmont and Mountain sections of the state may be the result of the stock from which they were derived. The Scotch, or Scotch-Irish as they are called, have been traced through Pennsylvania, Virginia, North Carolina, Tennessee, Kentucky, Missouri and to the Pacific Coast. They were pioneers in the colonial period and acted as a buffer between the Indians and the colonists on the Atlantic seaboard. Later they aided largely in the settlement of the west. They have been the tallest men of the United States. During the Revolution Virginia furnished some of the tallest men of the army in Morgan's Rangers, and such pioneers as Washington, Jefferson and Marshall, who were over six feet tall; during the War between the States the tallest soldiers were from Kentucky, the sons of Virginia, and during the World War the tallest soldiers came from Missouri. California is celebrated for its tall men.

The tall stature of Piedmont and Mountain may be the result of other factors than the stock of people, but this is one factor. The small stature of Tidewater may be partly the result of malaria and dysentery in the earlier colonial period, leaving a sturdier and stockier kind, and the moving out of the tall active, restless pioneer into the open spaces of the west where they joined the Scotch in maintaining the tall stature. A long experience among the mountaineers showed me their tall stature, and the recent measurements confirmed it. The examination and measurement of several hundred mountain children showed their superior physique. They had no malnutrition and they proved to be the best developed of all Virginia children so far measured.

The University of Virginia Free Dispensary provided the examination of some poor whites from Charlottesville and the surrounding district. The stature is 172.9 centimeters with extremes of 157.6 and 187.1. This is a heterogeneous group, although the extremes are not so great as in the morgue subjects measured at autopsy in the Charity Hospital, New Orleans, where the stature was 171.1 centimeters and the extremes 157.0 and 190.0 centimeters. Is the submerged tenth made up of extremes? The low stature of this group may be the result of disease or malnutrition, but the stature is not so low as that of the business men of Charlottesville, which is 171.0 centimeters, with extremes of 160.6 and 180.0 centimeters. This is a group comparable in social position with the Albemarle farmers, living in the same community, and with equal if not better opportunity for proper nourishment. It has been recognized that clerks are smaller than laborers and merchants than farmers. This is a difference of type and not the result of nourishment. The tall, active, restless pioneer develops the country, then the small, quiet, sedentary citizen builds towns and conducts its business. The pioneer may develop business, but usually lives in the country and the small man is left in the city. This is the selection by the fittest for what is for their best good.

A comparison of soldiers and students shows a difference in stature in favor of the students of about 3 centimeters. The students have a stature of 174.2 centimeters with extremes of 160.2 and 189.7 centimeters, and the soldiers have a stature of 171.0 centimeters with extremes of 152.0 and 191.0 centimeters. The students were University of Virginia men over 20 years of age, and the soldiers were engineers of the Truck Camp near-by also over 20 years of age. The students were more of the hypermorph type which is taller, whereas the soldiers were more of the mesomorph type which is not so tall.

SUMMARY

Tropic jungle life has an influence that decreases stature, and so has Arctic cold and waste. In each there is difficulty in procuring proper food, and discomfort in the extreme.

The active life of the temperate zone with its comforts and abundant food supply produces the tallest statures.

The greatest extremes of small stature are found among the Negrillos of Central Africa and the Aymaras of Central South America, in the jungles of excessive heat and poor food supply. Next to these come the Eskimos, Lapps and Siberians, with ice and excessive cold and poor food supply. On the other hand, the littoral and southern Baltic regions in Europe, the western part of Asia, eastern Africa, and the plains and pampas of the Americas with their active life, abundant food supply and temperate climate produce the tallest statures.

Certain stocks may move into areas for which they are not fitted and remain for a time, and such conditions exist throughout the world to-day where recent movements of peoples have taken place, but ultimately there is a survival of the stock best fitted for the environment, and the unfitted stocks disappear by amalgamation, eradication or dispersal.

Sea areas and probably sea food have an influence in reducing stature. The present Mediterranean peoples and the primordial British have small statures and so does Japan, yet they came from taller continental stocks. The Central Americans and Fuegians are smaller than the continental peoples near-by. The Malays and southern Asiatics are smaller than the peoples of the interior of the continent. Other instances might be cited.

There is some evidence that the seaboard statures of the United States are less than those of the interior, but other factors enter here.

Looked at in its broadest sense, environment molds the individual, selection retains the fittest under different environments, and heredity carries on the results.

R. BENNETT BEAN

THE FUNCTIONS OF SECTION M—ENGINEERING[1]

FROM time to time during the ages of his development man has accidentally discovered or invented various devices and processes that have enabled him to raise himself above the level of the rest of the animal kingdom, to better cope with the forces of nature and to adapt himself to his environment. With slowly accumulated experience he improved and developed these devices and processes until they came into general use among his fellows. Each forward step in man's ascent has been thus marked by some epoch-making discovery that expanded his power and improved his status. Doubtless from the beginning some men more than their fellows were endowed with powers of observation, deduction and ingenuity, and it is to them that the real progress of the race has been due. To such men various types of construction work were intrusted, and their experience and knowledge were passed on from generation to generation by a kind of apprenticeship and by word of mouth. Master craftsmen were thus developed who possessed some knowledge of materials and the design and construction of structures. It was from such ancestors that the modern engineer sprang.

Naturally with advancing knowledge of science, the work of the engineer—as the master craftsman came to be called—was profoundly affected. The uncertainties of his work were reduced and gradually analytical methods with reliable scientific data replaced the method of trial and error, although, alas! the latter is still employed in an altogether unjustifiable degree by engineers and by many industries. Frequently in the solution of an industrial problem it is necessary to guess because of the indeterminate nature of the problem. If one continues to guess as the problem recurs, it indicates a low order of intelligence and foresight among those who are responsible for the answer.

As a class engineers are now more concerned with the adaptation of existing knowledge to their needs than with the extension of knowledge. Occasionally their needs are such that they are, perforce, led to explore somewhat the boundaries between the known and the unknown, but they are generally content if this process develops empirical relations that satisfy for the moment their peculiar requirements or if some difficulty in design or operation is temporarily met. While for a time empirical methods may be sufficient, sooner or later every engineer and every industry will recognize the necessity for precise knowledge of processes and materials and for exact methods of analysis that can only be supplied through the aid of the fundamental sciences. No industry can feel secure until it is fully aware of the scientific basis of its various activities. Accretions to knowledge result from scientific research and developments in industry follow the adaptation of such knowledge through industrial research. Upon the combined result of scientific and industrial research depends the progress of civilization and the improvement of man's status.

Until recently men responsible for the design and construction of structures and for the control of industry were trained as apprentices and their effectiveness depended upon their natural adaptability for such work and their practical experience. The devel-

[1] Address of the vice-president and chairman of the Section of Engineering, American Association for the Advancement of Science, Nashville, December, 1927.

opment of scientific and technical education has, however, greatly modified the training of such men and it has increased their efficiency. The advancement of science has been so rapid during recent years that now even the best product of a technical school is only moderately well equipped to avail himself of the latest achievements of physicists, chemists and other specialists in the fundamental sciences. More and more the engineer must work in close cooperation with those concerned with these sciences, and, for certain classes of work, his own training will need to be greatly modified and expanded.

The dawning of a professional consciousness among American engineers dates from the organization of the American Society of Civil Engineers in 1852. This society was designed as a medium for enlarging the acquaintanceship among engineers and for the interchange of professional knowledge and experience. In 1852 there were few men other than civil engineers and military engineers who were engaged in activities of an engineering nature. There were millwrights, the antecedents of the mechanical engineer, who were versed in the installation and utilization of machinery, but a class consciousness among such men that would raise them above the level of the artisan had not yet developed. The rapid expansion of knowledge of the physical sciences and of industry that began in the latter half of the nineteenth century, increased the need for men competent to meet the expanding problems of industry and so specialized the work of the engineer that various divisions of the profession soon came to be recognized. It was inevitable that such specialization would develop a need for the organization of additional societies designed to promote the interests of these newer divisions of engineering and of the men concerned with them. Thus, the American Institute of Mining Engineers, whose name was recently changed to the American Institute of Mining and Metallurgical Engineers, was organized in 1871, the American Society of Mechanical Engineers in 1880, and the American Institute of Electrical Engineers in 1884. While these four organizations, which have come to be called the "founder societies," have taken leadership among engineering organizations, it is interesting to note that one society, the Western Society of Engineers, was organized in 1860, soon after the founding of the American Society of Civil Engineers. With the continued and rapidly increasing knowledge of science and its applications to the engineering industries, there has been during the present century a tremendous expansion in the number of specialized national engineering organizations, such as the American Society of Refrigerating Engineers, the American Society of Heating and Ventilating Engineers and the Institute of Radio Engineers and of local clubs and societies until there are now, I am told, over six hundred engineering societies of all kinds in the United States.

In 1874, Articles of Incorporation of the American Association for the Advancement of Science were granted by the commonwealth of Massachusetts. The purpose of the association, as defined by the constitution adopted on December 29, 1919, is "to promote intercourse among those who are cultivating science in different parts of America, to cooperate with other scientific societies and institutions, to give a stronger and more general impulse and more systematic direction to scientific research and to procure for the labors of scientific men increased facilities and a wider usefulness." In 1881 the association organized Section D, to promote interest in mechanical science; in 1885 the name of this section was changed to Mechanical Science and Engineering; in 1912 the section name was again changed to Section D (Engineering), and in 1919, when the new constitution was adopted, the old section became known as Section M (Engineering).

The functions of Section M have never been clearly defined. Presumably it was organized to promote the knowledge of engineering and to advance the interests of engineers, thus placing engineering in a class with those sections of the association that represent the fundamental sciences. Engineering, however, can not be classed as a fundamental science, although it is concerned with the application of such sciences to the constructive and industrial arts. It has often been characterized as an applied science, although the term would seem to be a misnomer, for there is no other science than pure science.

The manner in which the section can promote effectively the interests of engineers is by no means clear. When one considers the infinite variety of engineering associations that already exist it seems unlikely that Section M will function effectively if it is simply one of over six hundred engineering societies, each having very much the same aims. The mechanical engineer will pledge his allegiance to one or more national and local associations that are devoted to the particular interests, and especially to the technique, of his own profession; and so with the adherents of each of the other divisions of engineering. No profit will accrue from the continued multiplication of engineering associations; in fact, engineers generally recognize that the profession has already gone too far in the organization of national professional societies and that it would be a very great advantage to them if the number of such organizations could be greatly reduced. Apparently Section M has generally been considered as simply a non-specialized technical society with functions similar to those of any other engineering society. So long as this conception of the

purposes of the section exists it is inconceivable that it will occupy a position of any importance in the minds of engineers. Unless, therefore, its characteristics can be so modified that it occupies a place among its sister organizations that is unique, it has no justification for continued existence.

As has already been explained, the engineer is concerned with the adaptation of existing knowledge to the needs of the constructive arts; while the fundamental scientist is concerned with the advancement of learning through scientific research, and is rarely interested in the practical application of the results of his work. Because of the nature of their professional duties very few engineers find the time or the opportunity to keep abreast of the advances in abstract knowledge after the completion of their formal training, and, as a consequence, they are unacquainted with, if not positively indifferent to, the newer developments in science that might revolutionize their own work if these developments could be quickly assimilated and adapted to use.

There is, then, an opportunity for Section M to occupy a place of peculiar usefulness as the common meeting ground of the creators of scientific knowledge and of those who adapt such knowledge to the use and benefit of mankind. I would, therefore, suggest that a serious effort be made to so modify the aims of the section that it will effectively promote the association of scientists and engineers, and enable the latter to voice his scientific needs and his achievements in adapting science to industry, and the former to attempt to forecast the possible practical applications of some new theory that has been recently developed or of a discovery which, if it can be made useful, will be revolutionary in its character. I recognize the difficulties that are inherent to this plan but I hope that they may be overcome. Under such an arrangement it would seem to me that the programs for the section meetings might very properly include papers presented by representatives of the different divisions of engineering that will present the latest applications of scientific knowledge in each of these divisions, and by the exponents of the fundamental sciences that will present and interpret the possible applications of the latest discoveries in the several sciences. The advantages of such programs would seem to be obvious for, as has already been explained, the older societies are generally more concerned with the technique of engineering than with its theoretical or fundamental scientific basis.

In addition to programs for the meetings of Section M, such as I have just described, it would seem desirable that the American Association for the Advancement of Science foster the publication of a journal that will endeavor to present in a popular form the latest scientific data and discoveries with suggestions of their possible applications, so that engineers and those who are responsible for the management of our industries may more quickly than formerly have access to and utilize such information.

If, therefore, Section M can in some manner establish a bond of interest and sympathy between engineers and scientists so that the former will become more scientific and the latter more practical, the future of the section will become secure.

CHARLES RUSS RICHARDS

LEHIGH UNIVERSITY

EUGENE ALLEN SMITH

EUGENE ALLEN SMITH became State geologist of Alabama on April 18, 1873, and served continuously in that capacity until his death on September 7, of this year, or more than fifty-four years' service. Michael Tuomey was the first State geologist, appointed to the place when the State Legislature of 1847–48 created the department, with final approval on January 4, 1848. However, from the results accomplished by the Smith survey, it would seem that Eugene Allen Smith was also the Geological Survey of Alabama. He did not write all its reports, but he certainly dominated the entire program and policy of the survey. He published some very long and detailed accounts of Alabama's natural resources, to which almost all of his writings were confined, but most of his contributions were in the form of short and concise accounts, rather than exhaustive monographs. Furthermore, his writings cover a wide variety of subjects from the oldest rocks in the crystalline area to the recent sands at the seashore; from the metals to clays and sulphur; from agriculture to gold mining. In addition to his writings which found their way into print, he must have issued thousands of volumes in the form of letters and reports. No matter how unimportant the sample or the inquiry, it was his habit of sending back a courteous and complete reply. The office is filled with a tremendous mass of correspondence, including many volumes of copies made by presses in the days before carbon paper and the typewriter.

Eugene Allen Smith was born at Washington, Autauga County, Alabama, October 27, 1841, the son of Samuel Parrish and Adelaide Julia (Allen) Smith. On his mother's side his ancestry is traceable back to Governor William Bradford through Allyns, Phelps, Bishop, Fitch, Walcott and others. He attended the private school at Prattville and entered the public schools of Philadelphia at the age of 11. His work in the Philadelphia schools was a great inspiration to him, and in his own words: "I read

three or four pages of Latin each day just because my instructor liked for me to do so." It was also in Philadelphia that he composed and edited "The Half-Yankee Boy," several copies of which have been preserved. This interesting newspaper consisted of a double sheet or four pages, filled with excerpts from various sources, and on a wide variety of subjects. These were carefully lettered in ink and comprise one of the many clever and original ideas which filled his life. It was during this period between the Prattville schools and college that he developed a passion for carving. He used a penknife with amazing dexterity, as is attested to by the numerous articles left in his personal effects. Perhaps his most beautiful work was done on peach seeds, while some very nice things were done in wood. His designs were original and artistic, and the craftsmanship inspired.

At the age of nineteen he entered the junior class at the University of Alabama, where he received the A.B. degree in 1862. In April of that year all of the members of his class were sent to various parts of the state as instructors for drilling recruits. He was sent to Greenville and enlisted in Company K, the company which he was drilling, as a private. He was later elected a second lieutenant in this company, and was later detailed by President Davis as state captain and instructor in tactics at the University of Alabama. He served in this capacity from December, 1862, until April, 1865. Somehow the war and its heavy blow to the South had not entirely upset his life and plans, and he managed to go to Germany in October, 1865, to continue his studies. He spent a few months at the University of Berlin, a similar period at Göttingen and then went to Heidelberg. From the latter university he received the degrees of master of arts and doctor of philosophy *summa cum laude,* in 1868. While in Europe he spent his summers in travel, and, as would be expected, allowed the art galleries to consume a good bit of that time. Usually on these jaunts he was accompanied by some of his fellow students, "not because of their interest, but because they were on allowances also!"

Upon his return to America in December, 1868, he went to the University of Mississippi as assistant professor of chemistry, and was associated with the geological survey of the state, which was under the charge of Eugene Woldemar Hilgard. There can be no doubt but that Hilgard instilled in him much of his interest in geology. His first work was embodied in his report on the Mississippi bottoms. He remained at the University of Mississippi until May, 1871, when he was elected professor of chemistry and mineralogy in the University of Alabama. He was instructed by the trustees of the university to spend such time as was not required by his duties as a professor in the university to the study of the natural resources of the state, which he did at his own expense. It might be said in passing that the University of Alabama has always taken the lead in this important work.

In 1873 the Legislature passed an act "To revive and complete the Geological and Agricultural Survey of Alabama," and made a special appropriation of $2,200 for the purchase of an ambulance, team and other equipment. In addition to this, the sum of $800 was appropriated for chemical apparatus for the analysis of soil and ores, and $500 annually for a period of ten years for the expenses of the survey. Eugene A. Smith was appointed state geologist, to receive no compensation since his salary as a professor in the university was regarded as being sufficient remuneration for the added duties. During this decade he was assisted by Henry McCalley, of Huntsville, who gave his services to the work of the survey gratuitously. Much of the state was visited, and the results incorporated in the rather detailed reports of progress, and many shorter contributions which were published in various scientific journals.

He devoted the first part of this period to the metamorphic region, studying the formations at that time thought to be Pre-Cambrian. Later, he gave considerable attention to the coal and iron regions of the present Birmingham district, calling attention for the first time to the vast areas underlain by coal. The brown ores of Bibb, Shelby, Talladega and Calhoun Counties received all the consideration given iron ores since red ores were regarded as too low grade to be used as a source of iron. During the latter part of this decade, he was appointed special agent in the division devoted to cotton culture, for the 1880 census. This work carried him into the Coastal Plain country for his first intimate glimpse of the wonderful sections along the Alabama and Tombigbee Rivers. In addition to his reports for the census, he published his very fine and comprehensive "Report for 1881–82, embracing an account of the agricultural features of the State." All this had been accomplished on an appropriation of $500 annually!

In 1883 the wonderful work of the survey prompted the legislature to increase the annual appropriation to $5,000. This made it possible to do more efficient work, and to accomplish even greater results. McCalley was given general charge of the Warrior Coal Field, while Smith delved into the problems of the younger formations of the state, a work which perhaps gave him his greatest accomplishment and certainly his greatest enjoyment. Many field seasons were spent in the Coastal Plain region, and several reports record the results.

In 1891 the annual appropriation of the survey was increased to $7,500 and the work continued to enlarge and expand, and grow in importance. Reports appeared more frequently and on a greater variety of subjects. Smith had a large and important share in all this work, besides being charged with all administrative duties. With the natural enlargement of the work, the legislature in 1919 increased the annual appropriation to $12,600, where it remained until his death. His fast increasing duties as state geologist made it necessary for him to give up his work in the university in 1913, and he was made professor emeritus, and subsequently devoted all his energies to the work of the survey. For the first time in 1906 the state gave financial support to the state geologist, and $1,500 was designated as his salary. This was increased, over his protest, to $4,000 in 1919. His plea was that if there was anything available, he wanted it for the survey and not for himself. As the result of his final request of the legislature, the annual appropriation was increased to $50,000, and his survey was assured of adequate support for the first time in its history. The final passage of this bill was recorded during the first day of his fatal illness, but he had full knowledge of its successful voyage through the law-making channels.

His quarters at the University had evolved from a small laboratory in the basement of Wood's Hall, and later the lower floor of Garland Hall, to the handsome building which bears his name. This structure was completed in 1910, and houses the survey and the museum, with the departments of geology and biology occupying parts of the wings. He made the building and its surroundings the beauty spot of the campus, using his full knowledge of flowers and shrubbery to the very best advantage. Thus in the midst of an environment his very own, he was stricken on August 29 while at the breakfast table with an internal malady and had to be taken to the hospital for an immediate operation. The operation was successful, but his vitality was too low to allow him to recover from the shock. He succumbed at 4:30 P. M., on September 7, and was buried the following afternoon.

He was a life member of the American Association for the Advancement of Science, and was vice-president and chairman of Section E (Geology) in 1904 and elected again in 1926, which he declined because of his age. He was appointed honorary commissioner at the Paris Exposition in 1878; was a member of the council of the Geological Society of America from 1892–95, vice-president in 1906 and president in 1913; was honorary life-member of the American Institute of Mining and Metallurgical Engineers and received numerous other honors during his long and colorful career. Perhaps one of the greatest honors and distinctions came from the law makers of his own state, when he was named specifically in the statutes as state geologist. His resignation could only have been received by the State Legislature.

He always took an active interest in all of the affairs of the university, appearing at all its functions, especially the athletic contests. He would never go into enemy territory to a football game, saying "there is trouble enough at home without going away to hunt for it!" He enjoyed most the baseball games in which there was an abundance of base hits. The university loses one of its most loyal friends.

His bibliography carries more than 120 entries, which comprise about 5,000 pages, with hundreds of maps and illustrations. His contributions have been as valuable as voluminous, and his further achievement in directing the complicated affairs of the survey in such a way as to keep it intact for more than half a century and amply providing for its future constitutes an accomplishment which stands on its own merits.

The phenomenal development of the mineral industries of Alabama, which accompanied the progress of the work of the survey, must have given him a great deal of pleasure and satisfaction, but he never gave voice to any such emotion. The annual production of coal had gone from almost nothing to over 20,000,000 tons. Industrial plants emerged from the hillsides like mushrooms, and great mines and quarries were everywhere. He was directly responsible for the location of the cement plant at Spocari, near Demopolis, and he and Watt T. Brown brought about the establishment of the Ragland plant. These proved that cement could be successfully made in Alabama, and the growth of this industry has been remarkable. Surely his reward was in watching this progress in the development of the state he loved and for which he had devoted his life, without ever a thought of himself. He died, poor in this world's goods, but rich in its honor. His achievements had won for him the love and respect of all who knew him. His simple and beautiful life, his modesty and genial nature endeared him to his associates as "The Little Doctor." He had outlived all his contemporaries, passing from this life with the full knowledge that he had done everything he could for his work and for the state.

WALTER B. JONES,
State Geologist

ALABAMA

SCIENTIFIC EVENTS

THE LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE

A NEW department has been added to the London School of Hygiene and Tropical Medicine for an advanced course in bacteriology and immunology. A house has been secured for the purpose in Gordon Square, over the school in Endsleigh Gardens, and students will be prepared for the new diploma in bacteriology of London University. It will be opened next month, and the course of study will include the bacteriology of public health and of industry.

Another new department is to be opened in connection with the school, at the National Institute for Medical Research, at Hampstead, for special instruction in epidemiology and vital statistics. Other important developments are contemplated in the activities of the institution, but these can not be carried out until the completion of the new school, towards which the trustees of the Rockefeller Foundation gave $2,000,000. Good progress is being made with the building, which is being erected in Bloomsbury, near the British Museum, and, although it is not expected to be finished until 1929, it is hoped that a part will be ready for occupation by October of this year. In the new building the school will be one of the most important institutions in the world for research into various problems relating to health, both in temperate and tropical climates. The training of students in general public health work will be an outstanding feature of its activities, and, with a department which will act as a coordinating center for research in different countries, the school is expected to have a world-wide influence in the promotion of public health services.

Steps are also being taken to provide more efficient clinical teaching in tropical diseases, and an important proposal associated with the future work of the school relates to the erection of a hospital for tropical diseases. Such an institution is regarded as an urgent necessity, and it is hoped to raise sufficient funds to provide a suitable building in close proximity to the new school.

FREE PUBLIC LECTURES ON MEDICAL SUBJECTS

THE faculty of medicine of Harvard University offers a course of free public lectures on medical subjects, to be given at the medical school on Sunday afternoons, beginning January 8 and ending March 25, 1928. The lectures will begin at four o'clock.

January 8.—*Maintaining physical efficiency by work and play:* NORMAN W. FRADD, instructor in physical education.

January 15.—*Gas poisoning, electric shock and drowning:* DR. CECIL K. DRINKER, professor of physiology and assistant dean of the School of Public Health.

January 22.—*The laws of the heart:* DR. ALFRED C. REDFIELD, assistant professor of physiology.

January 29.—*The importance of diet in the treatment of anemia:* DR. GEORGE R. MINOT, clinical professor of medicine.

February 5.—*Aptitude measurements in vocational guidance:* JOHNSON O'CONNOR, in charge of the human engineering department, General Electric Company, West Lynn.

February 12.—*The child meets the family:* DR. HALLOWELL DAVIS, assistant professor of physiology.

February 19.—*Infantile paralysis:* DR. WILLIAM L. AYCOCK, associate in preventive medicine and hygiene.

February 26.—*Restoration of function in the mouth and teeth as a health measure:* DR. FRED A. BECKFORD, professor of prosthetic dentistry.

March 4.—*Brain disorders from the surgical standpoint:* DR. GILBERT HORRAX, instructor in surgery.

March 11.—*Cancer:* DR. DANIEL F. JONES, associate in surgery.

March 18.—*Public health aspects of canned food:* HENRY M. LOOMIS, secretary of the National Canners' Association, Washington, D. C.

March 25.—*Health conditions in Equatorial Africa contrasted with those in countries where sanitation prevails:* DR. RICHARD P. STRONG, professor of tropical medicine.

At Stanford University Medical School the forty-sixth courses of popular medical lectures will be given at Lane Hall on alternate Friday evenings as follows:

January 13.—*Psycho-analysis:* DR. JAMES L. WHITNEY.

January 27.—*Infantile paralysis:* DR. RUSSELL VAN ARSDALE LEE.

February 10.—*Cults, quacks and cures:* DR. EDGAR L. GILCREEST.

February 24.—*Chinese medicine:* DR. EMMET RIXFORD.

March 9.—*Protection against tuberculosis:* DR. FREDERICK EBERSON.

March 23.—*Prevention of heart disease:* DR. WILLIAM DOCK.

OFFICERS OF THE AMERICAN CHEMICAL SOCIETY

IN addition to the election of Dr. Samuel Wilson Parr, professor of industrial chemistry at the University of Illinois, president of the American Chemical Society, W. D. Bigelow, director of the research laboratories of the National Canners' Association, was reelected a director of the society from the fourth district and E. C. Franklin, professor of chemistry in

Stanford University, was again chosen a director from the sixth district.

The following were elected councillors-at-large: Edward Mallinckrodt, Jr., vice-president of the Mallinckrodt Chemical Works, St. Louis; Professor Harry N. Holmes, head of the department of chemistry in Oberlin College; Treat B. Johnson, professor of organic chemistry at Yale University.

Balloting for the fourth councillor resulted in a tie between William J. Hale, director of organic chemical research, Dow Chemical Company, Midland, Mich., and Joel H. Hildebrand, professor of chemistry in the University of California. The tie will be broken by vote of the society's council at the meeting in St. Louis early in April.

The election of officers of the professional divisions of the society was also announced.

DIVISION OF INDUSTRIAL AND ENGINEERING CHEMISTRY—R. J. McKay, New York, *chairman;* R. E. Wilson, Whiting, Ind., *vice-chairman;* E. M. Billings, Rochester, N. Y., *secretary-treasurer.*

PAINT AND VARNISH DIVISION—W. T. Pearce, Fargo, N. D., *chairman;* P. E. Marling, Dayton, Ohio, *vice-chairman;* E. W. Boughton, New York, *secretary-treasurer.*

DIVISION OF AGRICULTURAL AND FOOD CHEMISTRY—F. C. Blanck, Washington, *chairman;* R. C. Roark, Washington, *vice-chairman;* C. S. Brinton, Philadelphia, *secretary.*

DIVISION OF BIOLOGICAL CHEMISTRY—P. E. Howe, Washington, *chairman;* M. X. Sullivan, Washington, *secretary.*

DIVISION OF CELLULOSE CHEMISTRY—L. E. Wise, Syracuse, N. Y., *chairman;* J. L. Parsons, Erie, Pa., *vice-chairman.*

DIVISION OF CHEMICAL EDUCATION—B. S. Hopkins, Urbana, Ill., *chairman;* H. R. Smith, Chicago, *vice-chairman;* R. A. Baker, Syracuse, N. Y., *secretary;* J. L. Wood, St. Louis, *assistant secretary;* E. M. Billings, Rochester, N. Y., *treasurer.*

FERTILIZER DIVISION—E. W. Magruder, Norfolk, Va., *chairman;* W. H. Ross, Washington, *vice-chairman;* H. C. Moore, Chicago, *secretary.*

DIVISION OF HISTORY OF CHEMISTRY—L. C. Newell, Boston, *chairman;* T. L. Davis, Cambridge, Mass., *secretary.*

DYE DIVISION—M. L. Crossley, Bound Brook, N. J., *chairman;* E. B. Bolton, Wilmington, Del., *vice-chairman;* H. T. Herrick, Washington, *secretary.*

ORGANIC DIVISION—W. L. Evans, Columbus, Ohio, *chairman;* F. C. Whitmore, Evanston, Ill., *secretary.*

DIVISION OF GAS AND FUEL CHEMISTRY—A. C. Fieldner, Pittsburgh, *chairman;* S. P. Burke, New York, *vice-chairman;* O. O. Malleis, Pittsburgh, *secretary-treasurer.*

DIVISION OF MEDICINAL CHEMISTRY—A. W. Dox, Detroit, *chairman;* F. Fenger, Chicago, *vice-chairman;* A. E. Osterberg, Rochester, Minn., *secretary.*

PETROLEUM DIVISION—J. B. Hill, Philadelphia, *chairman;* F. W. Padgett, University of Oklahoma, *vice-chairman;* C. L. Johnson, Kansas City, *secretary-treasurer.*

SUGAR DIVISION—F. J. Bates, Washington, *chairman;* F. W. Zerban, New York, *secretary-treasurer.*

DIVISION OF WATER, SEWAGE AND SANITATION CHEMISTRY—S. E. Coburn, Boston, *chairman;* W. D. Collins, Washington, *secretary.*

RUBBER DIVISION—H. L. Fisher, New York, *chairman;* A. H. Smith, Akron, Ohio, *vice-chairman;* H. E. Simmons, Akron, Ohio, *secretary-treasurer.*

DIVISION OF COLLOID CHEMISTRY—H. B. Weiser, Houston, Texas, *chairman;* F. E. Bartell, University of Michigan, *secretary.*

OFFICERS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

A FULL account of the Nashville meeting of the American Association for the Advancement of Science by the permanent secretary will be printed in the issues of SCIENCE for January 27 and February 3. Officers were elected as follows:

President

Henry Fairfield Osborn, president of the American Museum of Natural History.

Vice-presidents and Chairmen of the Sections

A—Mathematics: R. C. Archibald, Brown University.
B—Physics: P. W. Bridgman, Harvard University.
C—Chemistry: C. E. K. Mees, Eastman Kodak Company.
D—Astronomy: J. S. Plaskett, Dominion Astrophysical Observatory, Victoria, B. C.
E—Geology and Geography: Frank Leverett, University of Michigan.
F—Zoological Sciences: M. F. Guyer, University of Wisconsin.
G.—Botanical Sciences: C. E. Allen, University of Wisconsin.
H—Anthropology: Fay-Cooper Cole, University of Chicago.
I—Psychology: H. C. Warren, Princeton University.
M—Engineering: R. L. Sackett, Pennsylvania State College.
N—Medical Sciences: A. J. Goldforb, College of the City of New York.
O—Agriculture: C. A. Mooers, University of Tennessee.
Q—Education: Truman L. Kelley, Leland Stanford University.

Secretaries of Sections

Sect. A (Math.): C. N. Moore, University of Cincinnati.
Sect. N (Med.): H. Austin, University of Pennsylvania.
Sect. H (Anthrop.): C. H. Danforth, Stanford University.

Members of the Council

A. H. Compton, University of Chicago.
Austin H. Clark, Smithsonian Institution.

Members of the Executive Committee

John Johnston, U. S. Steel Corporation.
David R. Curtiss, Northwestern University.

Committee on Grants

Karl Kellerman, Bureau of Plant Industry.
W. S. Adams, Mount Wilson Observatory.

Board of Trustees of Science Service

J. McKeen Cattell.

Finance Committee

A. L. Day (reelected).

SCIENTIFIC NOTES AND NEWS

DR. H. J. MULLER, professor of zoology at the University of Texas, has been awarded the $1,000 prize of the American Association for the Advancement of Science for his paper on "The Effects of X-radiation on Genes and Chromosomes," read at the Nashville meeting.

AT the meeting of the Geological Society of America held in Cleveland from December 29 to 31 the Penrose gold medal of the society was conferred upon Professor Emeritus T. C. Chamberlin, of the University of Chicago, in recognition of his distinguished contributions to geology.

SIR ERNEST RUTHERFORD, Cavendish professor of experimental physics and director of the Cavendish Laboratory at the University of Cambridge, has been elected a foreign associate member of the French Academy of Sciences. He was already a corresponding member of the academy.

THE council of the British Physical Society has awarded the Duddell medal for 1927 to Dr. F. E. Smith, F.R.S., director of scientific research at the Admiralty. This medal is given annually for work in connection with the development of scientific instruments or of materials used in their manufacture.

C. TATE REGAN, director of the British Museum (Natural History), and Dr. F. A. Bather, keeper of the department of geology in the museum, have been elected as honorary members of the Yorkshire Philosophical Society.

PROFESSOR P. KOEBE, of Leipzig, has been elected a member of the Saxon Academy of Sciences.

THE King of Belgium will confer upon M. Braillard, the president of the technical commission of the Union International de Radiophonie, the decoration of Chevalier of the Order of Leopold in recognition of his services to the cause of radio broadcasting.

PROFESSOR EDWIN G. BORING, director of the psychological laboratory at Harvard University, has been elected president of the American Psychological Association.

DR. MARSHALL H. SAVILLE, professor of American archeology at Columbia University, was elected president of the American Anthropological Association at the annual meeting held at Andover, Mass.

MISS ALICE C. EVENS, of the U. S. Hygienic Laboratory, Washington, was elected president of the Society of American Bacteriologists at the recent annual meeting in Rochester. Miss Evens is at present confined to a hospital with Malta fever, acquired during experimentation on the disease.

DR. C. MACFIE CAMPBELL, professor of psychiatry in the Harvard Medical School, has been reelected president of the Massachusetts Society for Mental Hygiene.

AT the annual meeting of the Royal Academy of Medicine in Ireland, Sir William Taylor was elected president, and Louis L. Cassidy, the secretary for foreign correspondence.

AT its annual meeting in Chicago in November, the American Society of Animal Production elected E. W. Sheets, chief of the division of animal husbandry of the U. S. Bureau of Animal Industry, *president.* H. T. Gramlich, head of the department of animal husbandry, University of Nebraska, was made *vice-president,* and James R. Wiley, professor of animal husbandry, Purdue University, *secretary-treasurer.*

PRESIDENT COOLIDGE has approved senate joint resolution no. 48 and senate joint resolution no. 49, providing for the filling of two vacancies on the board of regents of the Smithsonian Institution by the appointment of the Hon. Charles Evans Hughes and Dr. John C. Merriam.

DR. WILLIAM J. HALE, director of organic research of the Dow Chemical Company and past-chairman of the division of chemistry and chemical technology of the National Research Council, has been appointed chairman of a committee of the division to foster cooperative researches between industries and academic institutions. This cooperative plan was instituted by Dr. Hale while he was chairman of the division.

THE newly-organized economic committee of the League of Nations has appointed a subcommittee to prepare a program of inquiry into the economic employment of the riches of the sea. This committee will consist of Sir Sydney Chapman (Great Britain), M. Serruys (France), M. Jahn (Norway) and Mr. Ito (Japan). The main object of this inquiry is to decide whether and under what conditions, and in

what waters, the production of marine fauna might be organized.

IN honor of Dr. Marston Taylor Bogert, professor of chemistry at Columbia University and first Carnegie professor in international relations, the Czechoslovak Prague Rotary Club recently gave a dinner at which Professor Bogert delivered an address on "Chemistry and War."

PROFESSOR GORDON H. TRUE, of the animal husbandry division at the University of California, was the guest of honor at the annual dinner of the American Society of Animal Production at the Saddle and Sirloin Club, Chicago.

A DINNER was recently given in New Orleans in honor of Dr. Isaac M. Cline, meteorologist in charge of the New Orleans headquarters of the U. S. Weather Bureau, at which R. C. Watkins, vice-president and general manager of the Southern Pacific Lines, presented to Dr. Cline, on behalf of his company, a bronze tablet eulogizing his services in connection with the recent Mississippi Valley flood.

DR. WALTER M. BRICKNER is relinquishing the editorship of the *American Journal of Surgery* with the December issue. Dr. Brickner has conducted this journal since its establishment twenty-three years ago.

THE following joined the scientific staff of *Biological Abstracts* during 1927: Dr. Ezra Allen, Mr. Frank Haimbach, Dr. Nellie M. Payne, Dr. Oran Raber, Dr. George Hume Smith. The other members of the central editorial staff are: Dr. Mary Jones Fisher, Dr. Frederick V. Rand and Dr. J. R. Schramm.

DR. LUDLOW GRISCOM, who recently resigned as assistant curator of ornithology in the American Museum of Natural History, has been appointed research curator of zoology in the museum of comparative zoology at Harvard University, and not assistant director as has been incorrectly reported.

DR. JOHN RYAN DEVEREUX, of Chevy Chase, Md., has been appointed medical director for the Catholic Near East Welfare Association, and will leave for Europe within a few days to make a survey of sanitary and public health conditions in the Balkans for the association.

DR. THOMAS STOCKHAM BAKER, president of the Carnegie Institute of Technology, in Pittsburgh, expects to spend six weeks in Europe during February, March and April, to organize plans for the Second International Conference on Bituminous Coal at Pittsburgh.

G. PROCTOR COOPER sailed from New York on December 3 for Central America where he will make a study of forest conditions and collect specimens of woods and plants for the Yale School of Forestry, the New York Botanical Garden and the Field Museum of Natural History. The trip is made possible through the cooperation of the three institutions and of the United Fruit Company.

DR. WILLIAM TRELEASE, retired professor of botany at the University of Illinois, has returned from a half-year's stay in the European herbaria, where he has been accumulating data for a monograph on the American *Piperaceae* or true peppers.

DR. KURT KOFFKA, formerly professor of psychology at the University of Giessen and now holder of the William Allan Neilson chair of research at Smith College expected to arrive in the United States on January 3 and will begin his work after the Christmas holidays. Dr. Alexander Mintz, Russian psychologist, who is to be research associate to Dr. Koffka, has already arrived, together with Richard E. Hill, another research assistant.

DR. JOHN W. EVANS, F.R.S., left England on November 18 for Egypt and Palestine to undertake geological work for the Egyptian government and for the Zionist Board.

DR. JASPER C. BARNES, dean and head of the department of psychology and education of Maryville College, will give courses in psychology in the University of Wyoming during the next summer quarter.

THE fourth Ludvig Hektoen lecture of the Billings foundation of the Institute of Medicine of Chicago will be given by Dr. Francis Peyton Rous, of the Rockefeller Institute, January 27, at the City Club, on "The Genesis of Gallstones." The fourth Lewis Linn McArthur Lecture of the Billings Foundation will be given February 24, by Dr. Frank C. Mann, of the Mayo Clinic, Rochester, Minn., on "Experimental Peptic Ulcer."

DR. FRANKLIN C. MCLEAN, professor of medicine in the University of Chicago, addressed the Milwaukee Academy of Medicine on November 22, on "Some Problems in Edema."

PROFESSOR EINAR HILLE, of the department of mathematics of Princeton University, lectured on December 9 and 15 at the Bartol Research Foundation, on "Boundary Problems in Differential Equations with Special Reference to their Application to Schrödinger's Wave Equation." Professor Arnold Dresden, of the mathematical department of Swarthmore College, will give a lecture on January 10 at the foundation on "Special Devices used in the Solution of Problems by the Matrix Mechanics."

TRIBUTE was paid to the memory of a former U. S. Forest Service official, Major Frank A. Fenn, by the

United States Geographic Board at its November meeting, by naming for him a mountain in the Bitterroot Range in northern Idaho. Fenn Mountain lies within the Selway National Forest, near Kooskia, Idaho, where Major Fenn spent the last years of his life.

Dartmouth's new dormitory, being constructed on Tuck Drive at Hanover, will be known as "Gile Hall" in memory of the late Dr. John M. Gile, who was for many years dean of the Dartmouth Medical School and a trustee of the college.

Nature notes that on December 23 occurred the centenary of the death of Robert Woodhouse, the Cambridge mathematician, who was successively Lucasian and Plumian professor and was also the first director of the Cambridge Observatory.

Dr. Walter Le Conte Stevens, emeritus professor of physics at Washington and Lee University, died on December 29, aged seventy-nine years.

Dr. Ruliff Stephen Holway, emeritus professor of physical geography at the University of California, died on December 2.

Dr. Harry N. Gardiner, professor emeritus of philosophy at Smith College, was struck by an automobile on December 29 and died a few hours later. Dr. Gardiner was seventy-two years of age.

Dr. J. A. Kiernan, chief of the tuberculosis eradication division of the U. S. Bureau of Animal Industry, died on December 13, aged fifty-four years.

Dr. Albert Robin, professor of pathology and hygiene at Temple University, died on December 23 in the fifty-fourth year of his age.

According to *Nature*, Professor Archibald Liversidge, emeritus professor of chemistry in the University of Sydney, who died on September 26, leaving an estate of the value of £46,000, bequeathed to the University of Sydney two sums of money, £2,000 and £500, towards a scholarship and for the advancemenet of science in Sydney, respectively. Other bequests include £1,000 and £500 to Christ's College, Cambridge, towards a scholarship and a research lectureship in chemistry, respectively; £1,000 to the Royal School of Mines, towards a scholarship; £500 each to the Royal Society of New South Wales and to the Australasian Association, and also to the Chemical Society of London, towards research lectureships in chemistry, as well as a further £100 and his unpublished papers on scientific and chemical matters.

Among the public bequests willed by the late Mrs. Marrvat, of Dundee, is £200,000 for the foundation of traveling scholarships in engineering, electricity, aeronautics and music, to be open to natives of Scotland only, and to be known as "Sir James Caird's traveling scholarships."

UNIVERSITY AND EDUCATIONAL NOTES

Yale University's two-year drive for a $20,000,000 addition to its endowment fund ended on December 31 with the goal exceeded by $810,000.

Following the assumption of the duties of his office by the new dean of the Medical School of the University of California, Dr. Langley Porter, it was determined by the board of regents that all departments of the medical school be brought together on Parnassus Heights, San Francisco. This means that those medical school activities now conducted within a few departments on the Berkeley campus, such as pharmacology, biochemistry, bacteriology, etc., will be transferred to San Francisco as rapidly as space to accommodate them on Parnassus Heights becomes available.

Professor F. J. Sievers, head of the department of soils at the State College of Washington and chief of the division of soils at the Washington Agricultural Experiment Station, has been elected director of the Massachusetts Agricultural Experiment Station, at Amherst, with duties beginning February 1.

G. C. Shaad, professor of electrical engineering at the University of Kansas, has been appointed dean of the school of engineering and architecture.

B. M. Gonzales, head of the department of animal husbandry in the Philippine College of Agriculture, has been appointed acting dean of the college.

C. E. Lampman, of the University of Wisconsin, has been appointed head of the poultry department at the University of Idaho.

Dr. Otto Rahn, formerly head of the dairy physics department in the agricultural experiment station at Kiel, Germany, has been appointed professor of bacteriology in the Cornell Agricultural College.

Dr. Peter Kronfeld, of Vienna, until recently an assistant in the eye clinic of Professor Josef Muller, has been appointed assistant professor of ophthalmology at the University of Chicago. The appointment of Dr. Kronfeld is the first research appointment made under the Kuppenheimer Foundation, for which Mr. Louis Kuppenheimer recently gave the University of Chicago $250,000.

The following appointments have been made at the University of California: G. B. Harris, assistant in anthropology; T. W. Koch, assistant in geology, and Beryl Kautz, assistant in paleontology.

DR. A. K. MACBETH, reader in chemistry in the department of science at the University of Oxford, has been appointed professor of chemistry in the University of Adelaide, South Australia.

DISCUSSION AND CORRESPONDENCE

THE PERIOD OF GESTATION IN THE MONKEY, MACACUS RHESUS

So far as we know, there is no exact record on the length of the period of gestation in any primate other than man; hence the following report of mating and parturition in *Macacus rhesus* will prove of interest.

For over a year the female in question had been found to menstruate regularly in cycles of 26 days. The successful mating took place from the ninth to the twelfth day after the beginning of the last menstrual period and just before the leucocyte count of the vaginal content had reached zero. This is also about the time at which Corner (1923) and Allen (1927) had found ova in the Fallopian tube of the same species of monkey. For theoretical reasons, therefore, it is almost certain that conception took place within the three-day period when the female was left with the male. A male rhesus was born almost exactly six lunar months after conception.

From the fourteenth to the thirty-seventh day after conception the vaginal content of the prospective mother showed slight admixture of red blood cells. This phenomenon is regarded as the "placental sign," discovered by Long and Evans (1920) in the rat and interpreted as slight leakage from the developing placenta. In the rat the sign is infallible. The finding of a slight bleeding under similar conditions in the monkey arouses the hope that an easily ascertainable sign may be found in the first six weeks of human gestation. After the disappearance of the erythrocytes there followed a period of massive vaginal leucocytosis.

Details concerning the phenomena outlined above will be discussed in a fuller account to appear elsewhere.

CARL G. HARTMAN
CARNEGIE INSTITUTION OF WASHINGTON,
BALTIMORE, MARYLAND

THE FLOODS OF 1927 IN THE MISSISSIPPI BASIN

THE flood of 1927 whether measured by the volume of water carried, the area overflowed or the economic loss produced was the greatest of recorded history in the Mississippi Basin.

A full account is given by H. C. Frankenfield and others in a *Monthly Weather Review Supplement*. The setting for the flood was produced by heavy rains that fell as far back as the second week of August, 1926, over Kansas and Oklahoma and thence eastward to and including the greater part of the Ohio Valley. These rains so thoroughly saturated the soil throughout the middle drainage of the Mississippi that further heavy rains coming in September and October, 1926, caused general and in some cases destructive floods in the drainage above Cairo, Ill. The distribution of the rainfall from August to December, 1926, was such as to keep the main river and its tributaries at relatively high stages in a season when stages are normally low. Superposed on these conditions a record-breaking flood occurred in the Cumberland River late in December, 1926, continuing until early January, 1927, and thus the foundation was laid for a serious spring flood in the Mississippi, conditioned only upon the amount and distribution in time and space of the rains of January to April, both inclusive. It so happened that heavy rains fell in March and April and in such sequence as to produce a catastrophic flood in the lower Mississippi Valley. The rains of the third and fourth week of January, 1927, started a flood wave in the Ohio which continued down-river to New Orleans, reaching that place in 38 days. This was the second of a series of flood waves that passed down the river during the interval January–June, 1927, due to heavy rains in the middle drainage area. After the middle of March heavy rains fell between the mouth of the Des Moines and the mouth of the Ohio and during the last week of the month heavy rains also fell over the Missouri Valley south of Omaha, especially over the Kansas and Osage basins. These and other rains resulted in a crest stage at Cairo, Ill., of 52.8 feet on March 25 and that stage was followed by the maximum crest of 56.4 feet on April 20, and by lesser crests of 44.0 feet on May 19 and 49.7 feet on June 8. The characteristic feature of the 1927 flood was a series of flood waves as indicated by the data just given for Cairo, Ill. Higher stages than those recorded would have been experienced had the levees held.

The report contains an estimated stage that would have been recorded had the levees held all along the line. It also submits and discusses the maximum possible stage on the main river under the most favorable conditions. Space does not permit touching in detail upon these phases of the subject.

The progress of the several flood waves was accurately forecast by the Weather Bureau, at least a week, and, in some cases two weeks, in advance; the unique service, however, was furnished when the necessity arose of forecasting the depth of the wave of crevasse water that passed overland through the Atchafalaya Basin to the Gulf of Mexico. In the absence of a contour map for Louisiana, one had to be constructed, over-night, so to speak, by the New

Orleans Weather Bureau Office. By the aid of this map the Bureau was able to give timely warning of the flooding of parts of the Atchafalaya Basin and towns therein that never before in the 200 years since settlement of the region had been reached by flood waters.

A. J. HENRY

DIVISIONS OF THE DECORAH FORMATION

IN studying the stratigraphy and paleontology of the Ordovician Decorah formation in northeastern Iowa, it has been found advisable to divide the formation into three members, here named and defined. The lowest of the three, the Spechts Ferry member, has as its type locality the ravine southwest of the C. M. and St. P. railroad station of Spechts Ferry, Dubuque County, Iowa, at which place the eight and one half feet of shales and interbedded limestones form a lithologic unit lying above the "Platteville" limestone; the "Platteville" of Iowa does not include the uppermost beds of the typical Platteville of southwestern Wisconsin. The Spechts Ferry member includes the "glass rock" and overlying shales at the top of the typical Platteville. The member is of latest Black River (Watertown) age.

The middle member of the Decorah formation, here named the Guttenberg, consists of about fifteen and one half feet of brownish, fine-textured limestone at its type section in the bluff of the Mississippi River just northwest of the town of Guttenberg, Clayton County, Iowa; northward from this locality this limestone grades into shale. In northwestern Illinois the Guttenberg is the "oil rock" member at the base of the Galena formation.

In the N. W. ¼ of sec. 35, T. 96 N., R. 4 W., the Guttenberg limestone is overlain by sixteen feet of calcareous shale and argillaceous limestone that constitute the type section of the top member of the Decorah, here named the Ion member. The type locality is about a mile southwest of the hamlet of Ion, Allamakee County, Iowa. The Ion beds become more argillaceous to the northward, more calcareous to the southeastward.

The limestones of the two upper members of the Decorah have been irregularly dolomitized in the southeast part of their Iowa outcrop. The Guttenberg and Ion members are of basal Trenton (Rockland) age.

The Decorah formation thus consists of three members, in descending order, the Ion, Guttenberg and Spechts Ferry members, the type localities of which have been designated.

G. MARSHALL KAY

COLUMBIA UNIVERSITY

A DAYLIGHT METEOR

I READ with interest the two notes that appeared in SCIENCE, entitled "A Daylight Meteor," the one of William L. Bryant which appeared in the issue of July 22, 1927, and that of Frederick H. Getman of October 14, 1927. These recall a daylight meteor which I saw in May, 1890.

I was working in a gravel pit at Maxwell, near Des Moines, Iowa, when my attention was drawn to a streak of bright red which dashed from 15 degrees west of the zenith toward the northeast, like a streak of lightning out of a clear sky, for there was not a cloud in sight. I called other workers' attention to it, all concluding that it alighted six or eight miles about north of us—when the papers the next day gave an account of its falling 400 miles distant, in northern Minnesota. The papers also stated that it exploded just before reaching the ground, and that the concussion caused by same broke out all the window lights in several small settlements in the vicinity of where it fell.

This meteor left a trail of smoke (and dust?) behind it which drifted about in the sky all the rest of the afternoon, not having settled at dark that night. This streak of smoke first appeared in a straight line along the line the meteor had fallen, then became wavy, showing different currents of air acting upon it.

ALBERT B. REAGAN

INDIAN FIELD SERVICE, ARIZONA

INTERFERENCE?

WHILE on a large forest fire on the Columbia National Forest in Washington, August, 1927, an unusual optical phenomenon was observed shortly after noon one day. The sky was clear save for the smoke column from the fire. This column was very compact, so much so that the upper protuberances had the appearance of burnished metal and the disc of the sun was not discernible through the smoke. The angle of the sun with respect to the observer was slightly below the top of the smoke column. On the N or NNW side of the top of the column there was a broad band of black. This band did not quite touch the smoke column, there was a narrow ribbon of blue sky visible in between, but it extended outward for several hundred feet, assuming that it was a mile or mile and a quarter distant. The band did not appear to be a shadow, there could have been nothing behind it but blue sky yet it seemed as opaque as a strip of black cloth hung in the sky. It is unfortunate that a camera was not available as it probably would have photographed with good definition.

Perhaps someone can explain the optics of this odd phenomenon.

A. GAEL SIMSON

QUOTATIONS

DR. F. A. BATHER

IN February next, after forty years' service in the British Museum (Natural History), Dr. F. A. Bather retires from the post of keeper of the department of geology. His vigorous and cheery personality will be missed by geologists visiting the museum no less than by his colleagues. Educated at Winchester and Oxford, he joined the staff of the British Museum in 1887 as assistant in the department of geology and was placed in charge of the echinoderma. After becoming assistant keeper, and later deputy keeper, he succeeded Sir Arthur Smith Woodward as keeper of the department in 1924. Dr. Bather was elected F.R.S. in 1909; was awarded the Lyell medal by the Geological Society in 1911; has been president of section C of the British Association and of the Museums Association; he is now president of the Geological Society. Dr. Bather's original work on the paleontology of the echinoderms has gained him a world-wide reputation, and amongst the distinguished paleontologists of today he stands in the front rank. His memoirs and papers are too well known to need mention here; not only are they models of scientific method, but also they possess a literary charm seldom found in the writings of scientific authors.

In his presidential addresses to section C of the British Association at Cardiff (1920), and to the Geological Society last February, Dr. Bather dealt in a masterly manner with the principles of paleontology, and his listeners felt that those addresses were worthy of Huxley. Dr. Bather does more than look on fossils from the point of view of a morphologist and evolutionist; as is so well shown in his "Caradocian Cystidea of Girvan," he regards them as animals which once lived, and endeavors to correlate form with function, morphology with physiology. For several years Dr. Bather contributed the section on Echinoderma to the *Zoological Record;* although these are masterpieces of bibliography and analysis, one can not avoid a feeling of regret that so much of his time was taken away from original research. In another direction, by the active interest which he has taken in the work of the Museums Association, Dr. Bather has rendered good service to his country; he has contributed many papers to the association's journal dealing with the preparation and exhibition of specimens and other matters of importance to the curators of provincial museums. After his release from the cares and responsibilities of office, all who know Dr. Bather, whether personally or only from his writings, will fervently hope that leisure and health will enable him to continue for many years his splendid work in paleontology.—*Nature.*

AMENDMENTS TO THE INTERNATIONAL RULES OF ZOOLOGICAL NOMENCLATURE

UPON unanimous recommendation by the International Commission on Zoological Nomenclature, the International Zoological Congress, which met at Budapest, Hungary, September 4–9, 1927, adopted a very important amendment to Article 25 (Law of Priority) which makes this Article, as amended, read as follows (*italicized type represents the amendment;* Roman type represents the old wording):

Article 25.—The valid name of a genus or species can be only that name under which it was first designated on the condition:

(a) That (*prior to January 1, 1931*) this name was published and accompanied by an indication, or a definition, or a description; and

(b) That the author has applied the principles of binary nomenclature.

(c) *But no generic name nor specific name, published after December 31, 1930, shall have any status of availability (hence also of validity) under the Rules, unless and until it is published either*

(1) *with a summary of characters (seu diagnosis; seu definition; seu condensed description) which differentiate or distinguish the genus or the species from other genera or species;*

(2) *or with a definite bibliographic reference to such summary of characters (seu diagnosis; seu definition; seu condensed description). And further*

(3) *in the case of a generic name, with the definite unambiguous designation of the type species (seu genotype; seu autogenotype; seu orthotype).*

The purpose of this amendment is to inhibit two of the most important factors which heretofore have produced confusion in scientific names. The date, January 1, 1931, was selected (instead of making the amendment immediately effective) in order to give authors ample opportunity to accommodate themselves to the new rule.

The commission unanimously adopted the following resolution:

(a) It is requested that an author who publishes a name as new shall definitely state that it is new, that this be stated in only one (*i.e.*, in the first) publication, and that the date of publication be not added to the name in its first publication.

(b) It is requested that an author who *quotes* a generic name, or a specific name, or a subspecific name,

shall add at least once the author and year of publication of the quoted name or a full bibliographic reference.

The foregoing resolution was adopted in order to inhibit the confusion which has frequently resulted from the fact that authors have occasionally published a given name as "new" in two to five or more different articles of different dates—up to five years in exceptional cases.

The three propositions submitted by Dr. Franz Poche, of Vienna, failed to receive the necessary number of votes in commission to permit of their being recommended to the Congress. Out of a possible 18 votes for each proposition, Poche's proposition I received 9 votes, II received 6 votes, and III received 7 votes.

Zoological, medical and veterinary journals throughout the world are requested to give to the foregoing the widest possible publicity in order to avoid confusion and misunderstanding.

C. W. Stiles,
Secretary to Commission

SPECIAL ARTICLES

A NOTE ON THE CHROMOSOMES OF MOINA MACROCOPA

Banta and Brown[1] have shown that this cladoceran as well as certain others may be induced to increase the number of males by crowding parthenogenetic mothers. In order to study chromosomal evidence, several hundred parthenogenetic and sexual females have been sectioned. The most favorable time for observing the chromosomes is just before and after the eggs are laid.

The nucleus of the young egg is characterized by a number of deeply-staining granules, which increase in number and size until they fill the nucleus excepting a thin space beneath the membrane. This substance is not chromatin, as it does not react to chromatin stains after fixation in Gilson's fluid. Shortly before the eggs are laid, the mass breaks up into very fine granules, forming a homogeneous material which extends to the nuclear membrane. It gradually loses its staining properties until it appears relatively faint. At this stage there appears near one side a small, faintly-outlined spindle with a few irregularly shaped bits of chromatin within it. At about this time the nuclear membrane begins to dissolve, and the granular substance mingles with the yolk. In it very small, apparently ellipsoid chromosomes appear, and at a little later stage a well-defined spindle appears at the periphery of the egg, lying usually at right angles to the egg membrane.

[1] Banta, A. M. and Brown, L. A. 1923. Some data on control of sex in Cladocera. Eugenics, Genetics and the Family, Vol. 1.

After the egg is laid, the first division occurs: in the parthenogenetic egg without reduction in the number of chromosomes. In the sexual egg, the first maturation division results in the haploid number, which is 11. The diploid number is 22 in both types of egg. In the eggs of crowded mothers which should produce a high percentage of males, no evidence has yet been obtained indicating that the male number of chromosomes is haploid. Several such crowded mothers have been studied.

The chromosomes have not been seen in the form of rods. They are too small to determine whether tetrads are formed in the maturation divisions. It does not seem that their nearly spherical shape can be accounted for by faulty technique, as the tissues in general are in excellent condition.

With the exception of Schräder's work,[2] the number of chromosomes reported for Cladocera is not more than 8 or 8–10. Schräder reports 24. The chromosomes in *Moina macrocopa* have been previously studied, so far as the author can learn, only by Weismann and Ischikawa,[3] who report 4 in the females of *Moina paradoxa* (now *M. macrocopa*) and *M. rectirostris.*

The sperm cells in *Moina macrocopa* are extremely small in all stages, and thus far have yielded no satisfactory pictures of chromosomes.

Ezra Allen
Carnegie Institution for Experimental Evolution

GENETIC EVIDENCE THAT THE CLADOCERA MALE IS DIPLOID

Cladocera males have long been supposed to be diploid in chromosome make-up. Because of the difficulty of Cladocera material for cytological study, not much evidence on this point has been produced. Chambers (1913, Biol. Bull; 25, p. 134) reported the male Simocephalus vetulus as having "considerably more than eight" chromosomes, which number he found in spermatogenesis. Miss Taylor (1914, Zool. Anz.; 45, p. 21) gave 8 or 10 as the diploid number in male *Daphnia pulex* and 4 or 5 as the reduced number in spermatogenesis. In view of the much larger chromosome numbers, 24 in females, found in material of a *Daphnia pulex* type studied by Schrader (1925, Zeit. ind. Abs.-u. Vererbungslehre; 40, p. 1) and by Dr. Ezra Allen in Moina macrocopa (about 20 in females) compared with the reports of these earlier workers, verification of the supposed diploid condition of the Cladocera male seemed desirable.

We are now in a position to report genetical evi-

[2] Schräder, F. 1925. The cytology of pseudosexual eggs in a species of Daphnia. Zeit. f. induktive Abstammungs- und Vererbungslehre, Bd. XL, Heft 1/2.

[3] Weismann, A., and Ischikawa, C. 1891. Ueber die Paracopulation in Daphnidenei. *Zoöl. Jahrb. Bd. 4.*

dence on this point. Individual males of *Daphnia longispina* from three different lines which were known to be heterozygous for one or more mutant characters were mated with (usually) 8 to 16 sexual egg bearing females of a stock known not to carry these (dominant) mutant characters. These sexual eggs hatch poorly but from four such crosses (all of these crosses from which we have reared more than a single individual) we have had offspring of two classes—those with, and those without the mutant character. In two of these crosses, two dominant mutant characters were involved and segregation in the male occurred for both characters.

Since it is obvious that chromatic reduction and segregation are not to be expected in a haploid male, the demonstration of segregation in these males constitutes genetic evidence that they are diploid.

ARTHUR M. BANTA,
THELMA R. WOOD

CARNEGIE INSTITUTION
OF WASHINGTON,
COLD SPRING HARBOR, L. I.

PENTATHIONIC ACID, THE FUNGICIDAL FACTOR OF SULPHUR

IN a previous paper (Young, '22)[1] it is pointed out that pentathionic acid is the fungicidal factor accompanying sulphur. It is further stated that this acid is a product of oxidized sulphur resulting only when oxygen and water are present. These earlier tests proved also that particulate sulphur is more readily oxidized and consequently more fungicidal than ordinary sulphur. This work was confirmed in the main by Tisdale ('25),[2] and its practical application by Lee and Martin ('27).[3] The conclusions have been questioned by some English workers ('25).[4]

During the present summer, the writers continued this investigation with the aim in view of ascertaining the definite chemical relationship of the toxic factor of sulphur to sulphur itself and to determine the effect of certain factors influencing this relationship. We assumed at the outset that the conclusion reached by Freundlich and Scholz ('22)[5] that pentathionic acid is a peptizing agent for sulphur made by the reaction of H_2S and SO_2 and confirmed by Kruyt ('27),[6] the latter giving a simple diagram of the structure of the sulphur particle peptized by the pentathionic acid $(S)S_5O_6 = \begin{matrix} H+ \\ H+ \end{matrix}$, is correct. In all previous work it was generally supposed that pentathionic acid is peculiar to colloidal forms of sulphur. However, if a test for pentathionic acid (the ammoniacal silver nitrate test given in Mellar's Modern Inorganic Chemistry) is applied to sulphur the characteristic brown color develops and slowly changes to black. Hydrogen sulfide, or the sulfide ion, is the only sulphur compound that might give the same test. When flowers or flour of sulphur is treated with lead acetate, copper sulfate, or silver nitrate, no precipitate of the respective sulfides appears. Sulphur treated with ammoniacal copper sulfate gives no precipitate even on standing; likewise, no sulfide ion is obtained when sulphur is treated with ammonium hydroxide for several hours. Moreover, known solutions of sulfite, sulfate or thiosulfate ions do not respond to the above test for pentathionic acid. It can only be concluded that ordinary forms of sulphur have associated with them pentathionic acid. Our tests showed further that the acid is adsorbed quite completely by the sulphur particle, so much so that none can be washed off, as can be done in the case of hydrophilic colloidal sulphur using a simple ultra filter. The ordinary particle of sulphur flour is hydrophobic, partly because the pentathionic acid is too small in amount to effect hydration to an observable extent. However, when pentathionic acid is added to amorphous sulphur, it, along with other factors, causes complete hydration.

Strong ammonia destroys pentathionic acid if treated for some time, breaking it down to thiosulfate. Freundlich and Scholz used this treatment in determining the acid quantitatively by titrating the thiosulfate with iodine. They give the following reactions:

$$2NH_4OH + H_2S_5O_6 \rightarrow (NH_4)_2S_3O_6 + S_2 + H_2O$$

$$2(NH_4)_2S_3O_6 + 6NH_4OH \rightarrow (NH_4)_2S_2O_3 + 4(NH_4)_2SO_3 + 3H_2O + 4S$$

$$2(NH_4)_2S_3O_6 + 6NH_4OH \rightarrow 5(NH_4)_2S_2O_3 + 3H_2O$$

On the other hand, strong ammonia does not completely destroy the $S_5O_6 =$ ion on the sulphur particle. In this case, we are not dealing with free pentathionic acid but with strongly adsorbed $S_5O_6 =$ which is not free. Consequently, when the pentathionic acid test is used on ammonia-treated sulphur, the nega-

[1] Young, H. C. The toxic property of sulphur. Ann. Mo. Bot. Gard. 9: 403–435, 1922.

[2] Tisdale, L. E. Colloidal sulphur: preparation and toxicity. Ann. Mo. Bot. Gard. 12: 381–418, 1925.

[3] Lee, H. Atherton, and J. P. Martin. The development of more effective dust fungicides by adding oxidizing agents to sulphur. SCIENCE 66: 178, 1927.

[4] Discussion on "The fungicidal action of sulphur." Ann. of Apl. Biol. 13: 308–318, 1925.

[5] Freundlich, H., and P. Scholz. Ueber hydrophobe und hydrophile Sole des Schwefels. Koll. Beih. 16: 234–266, 1922.

[6] Kruyt, H. R. "Colloids" translated by H. S. Van Klooster. John Wiley & Son (Inc.) Page 238, 1927.

tive $S_5O_6=$ ion and the negative sulphur particle attract the positive $Ag(NH_3)_2+$ ion which reacts with the $S_5O_6=$ to form the characteristic compound which is in the end Ag_2S. A parallel case of the difference of reactions from normal under conditions of powerful adsorption is that a quantity of HCl sufficient to invert sugar will not do so when in a system adsorbed by charcoal.

Since pentathionic acid is present on most forms of sulphur and such forms of sulphur show a degree of toxicity, it is reasonable to assume that the acid is, or contains, the toxic factor. A complete proof of this was obtained by freeing sulphur of this acid and testing it for toxicity. At the outset it was found that when pure pentathionic acid was treated with strong ammonia, then brought back to pH6, or even more acid with HCl, the spores of *S. cinerea* and *V. inequalis* germinated as freely as in the checks. When sulphur was treated with strong ammonia and brought back to pH6, immediate germination tests were positive, but the suspension soon became toxic. Sulphur in the presence of oxygen and moisture is a continual source of pentathionic acid until equilibrium is reached. When the reaction was kept between pH7–7.5, the suspension was only slightly toxic. The oxidation of sulphur probably proceeds as follows:

$$S + O_2 \rightarrow SO_2$$
$$SO_2 + H_2O \rightleftarrows H_2SO_3$$
$$H_2SO_3 + S \rightleftarrows H_2S_2O_3$$
$$5H_2S_2O_3 \rightarrow 2H_2S_5O_6 + 3H_2O$$

In view of these reactions, which indicate the formation of pentathionic acid at the expense of sulphur, oxygen, and water, and those showing the alternate breakdown of this acid by ammonia into ammonium thiosulphate and sulphur, the difficulty Freundlich and Scholz experienced when trying to estimate pentathionic acid in the presence of sulphur can be explained. The reactions also account for the fact that although a solution of pentathionic acid with an added excess of ammonia fails to give a positive test for $S_5O_6=$, the free sulphur thrown down as indicated in the step reactions develops sufficient $S_5O_6=$ to give a positive test on standing. This entire procedure can account for the way ammonia gradually dissolves sulphur.

Sulphur prepared from H_2S and SO_2 is affected by strong ammonia in the same way except that the $S_5O_6=$ ion is much more abundant, reacting more quickly to the pentathionic acid test and recurring more quickly after the sulphur has been treated with ammonia.

Pure pentathionic acid is not so completely destroyed with bases such as $Ca(OH)_2$, KOH, or NaOH. These react directly, each forming the respective pentathionate which gives a positive test. They were non-toxic to the organism used but regained their toxicity when brought to pH6, or below, with HCl. All the germination tests were made in hanging-drop cultures in Van Tieghen cells, and results are given in the table.

GERMINATION TESTS WITH VARIOUS TYPES OF SULPHUR

Treatment	Germination S. Cinerea	Germination V. inequalis
	%	%
1. Pentathionic acid, .062%	0	0
2. " " .03 %	2	trace
3. " " .0075	4	5
4. Pentathionic acid .03% + strong ammonia, then acidified to pH6 with HCl	80	.....
5. Pentathionic acid .03% + CaOH then brought back to neutral pH7 with HCl	72	.....
6. Pentathionic acid .03% + CaOH then brought back to pH5 with HCl	trace	.....
7. Check-distilled water to pH7 with slight $Ca(OH)_2$	80	70
8. Ground flour of sulphur treated with strong ammonia then thoroughly washed with O_2 free water	27	.....
9. Ground flour of sulphur washed with O_2 free water	1.6	.....
10. Ground flour of sulphur treated with $Ca(OH)_2$ then brought to 6.4 with HCl	5	.....
11. Ground flour of sulphur treated with gelatin to aid wetting	trace	.....

It is quite evident from the above results that pentathionic acid is the toxic factor of sulphur and that this compound is quite sensitive to basic materials. They further show that the natural oxidation and dissolving of sulphur gives a continuous yield of pentathionic acid. Particulate sulphur oxidizes more readily as would be expected in such systems, and consequently is more toxic. The results explain why failures occur with so many commercial dusts and sprays which have been made up more from the standpoint of spreading and sticking than maintaining toxicity. Basic compounds aid in spreading and sticking but inhibit toxicity.

H. C. YOUNG
ROBERT WILLIAMS

SCIENCE NEWS

Science Service, Washington, D. C.

SOME PAPERS PRESENTED AT THE NASHVILLE MEETING

DR. R. G. AITKEN, who is in charge of the Lick Observatory of the University of California, delivered the address as retiring vice-president of the astronomical section of the American Association for the Advancement of Science. Taking Dr. Barnard, who was a native of Nashville, and whose astronomical career largely began at the previous meeting of the association there in 1877, as the subject of his address, Dr. Aitken related many personal reminiscences. "On September 17, 1881, he found a comet and he sent word of the discovery to Lewis Swift, and through him to astronomers generally. This comet was therefore carefully observed and is known, in the annals, as Comet 1881 VI. This discovery had important consequences quite other than its bearing upon his reputation as an observer. Mr. H. H. Warner, of Rochester, New York, had offered a prize of $200 for each unexpected comet discovered by an American observer. This prize came to Barnard for the discovery of Comet 1881 VI; Mrs. Barnard felt that the money must be used for some definite purpose, and with her encouragement, and faith that later payments would be met "somehow," and that they would "manage," it was accordingly used as the first payment for a house. Faith backed by hard work had its due reward, for Mr. Warner's offer was continued for several years, and Barnard actually won enough prizes for cometary discoveries to pay for the 'Comet House,' as it is still known here in Nashville and to all astronomers." Upon the founding of the Lick Observatory in 1887 Barnard, then at the age of thirty, joined its staff. Later he went to the Yerkes Observatory, in Wisconsin. Among the many important discoveries which he made were those of the fastest-moving known star, and also the second closest, the first moon of Jupiter to be found since 1610, the "Gegenschein" or faint glow of light that appears in the sky opposite the sun, as well as numerous comets and double stars. As a great astronomer, concluded Dr. Aitken, Barnard was "honored by astronomers throughout the world. Barnard, the modest, simple-minded, unselfish, kindly man was loved by every one who knew him."

THE millions of dollars invested in the movies and the pleasure of the millions of people who daily attend them is based on chemical impurity in gelatine. This announcement, in effect, was made in a lecture given in conjunction with the meeting, by Dr. C. E. K. Mees, director of the Research Laboratory of the Eastman Kodak Company. "It has recently been found," said Dr. Mees, "that the sensitiveness of films is not due to the grains of silver bromide only, but is in some way connected with the presence on those grains of specks of some other substance, and the Kodak Research Laboratories after a long and careful study have found that these specks are produced by an accidental impurity present in the gelatine. This impurity is derived from the plants eaten by the animals from whose skins the gelatine is made. There is only a very small amount of it, but it is a compound which contains sulphur, and when the gelatine is used for making the film, the sulphur reacts with the silver bromide and produces specks of silver sulphide on the crystals. In some way or other these specks increase the effectiveness of the light to which the film is exposed in the camera and enable the light to change the silver bromide so as to form a trace of metallic silver. Then this silver acts during development as a nucleus on which more silver can deposit by the chemical process until the whole of the silver bromide crystal is turned into silver. Each of the original crystals of the film therefore, after exposure to light, becomes a grain of silver in the developed film, and it is of these grains of silver that the image projected on the screen is composed."

AN immediate investigation of the earthquake situation in the Mississippi Valley was urged by Commander N. H. Heck, in charge of the seismologic work of the U. S. Coast and Geodetic Survey, who spoke before the American Association for the Advancement of Science. Calling attention to the fact that one of the great earthquakes of all history occurred in the New Madrid region of the Mississippi Valley in 1811–12, Commander Heck intimated that there was a possibility that history would repeat itself, although it can not be foretold what the future will bring. Occasional minor earthquake shocks have been felt in the Mississippi Valley and along the Ohio River in past years and one of the sharpest of these shocks was on April 9, 1917. Another occurred at the time of the great Mississippi flood. Probably the fact that flood and earthquake came at the same time was merely a coincidence that serves to call attention to the damage that would be done by a major earthquake in that region to-day. "Thorough examination of the situation in the entire Middle Western region subject to earthquakes is desirable," Commander Heck said. "There is little doubt that the first investigation should be confined to the area surrounding the New Madrid region. Dr. James B. Macelwane, S. J., director of the Jesuit Seismological Association, has proposed such a plan, and it is endorsed by Dr. Arthur L. Day, chairman of the advisory committee of seismology of the Carnegie Institution of Washington, who is in charge of the earthquake investigation in California which is being made with the cooperation of the national government, various state institutions, including the universities, various other groups and the citizens of California. This organization has all that it can take care of in the California problem and the government activity as carried on by the United States Coast and Geodetic Survey is fully occupied with taking care of earthquake information for the United States and the regions under its jurisdiction, and operating its own observatories so that it is left for the Middle West to work out its problem. Its rapidly-growing cities make it important that this problem be attacked.

X-RAYS played a highly important part in the discussions of the biologists at the meeting of the association and its affiliated societies. Within recent months many workers in various parts of the field have discovered this type of radiation to have almost miraculous powers to change the course of events in the development of living organisms, and to leave so deep an impress on their substance that their descendants for many generations will show the effect of their ancestors' experience. Professor Winterton C. Curtis and Raymond A. Ritter, of the department of zoology at the University of Missouri, told of their researches on the effects of X-rays on the development of growing tissue. They experimented on a small marine animal related to the jelly-fish, which reproduces itself by constantly budding off new individuals very much as a tree produces branches. After exposure to the X-rays for ninety minutes the animals lost the power of producing new individuals, although the original parent portion remained alive. Professor H. J. Muller, of the University of Texas, who recently startled the scientific world by speeding up evolutionary processes over a hundred-fold with heavy X-ray doses applied to a small insect, the fruit-fly, reported further on his work and displayed specimens showing the results of his technique. Professor Frank B. Hanson, of Washington University, St. Louis, who has been collaborating with Professor Muller, reported the effects of the rays on the rapidity with which the insects reproduce. Professor Robert T. Hance, of the University of Pittsburgh, told of some of the first results of X-ray experiments on warm-blooded animals. The hair color of mice exposed to very light doses of the rays in his laboratory was radically changed. Normally "mouse-colored" mice of mixed ancestry went completely white after being rayed, while pure-bred mice of the same color changed in the opposite direction and became darker. Dr. H. J. Bagg, of Memorial Hospital, New York City, and Dr. Clarence R. Halter, of Cornell University Medical College, working in collaboration, were also among the first to obtain positive results with warm-blooded animals. Their mice developed certain marked bodily defects, such as possessing only one kidney instead of two, abnormal eyes, and legs in bad condition at birth. Such defects occur among mice bred under ordinary conditions, but not so often as among X-rayed animals.

PLANTS as well as animals respond to X-ray treatment. Professor T. H. Goodspeed, of the University of California, has obtained results in the breeding of X-rayed tobacco plants which are comparable with those of Professor Muller on fruit-flies. The new varieties produced in this way have a stronger growth and produce more flowers than their cousins descended from un-rayed parents. Professor L. J. Stadler, of the University of Missouri, has conducted similar experiments with corn and barley. In these, as in all the other animals and plants on which the treatment has been tried, the hereditary units or genes have been knocked out of place and more or less violently rearranged, resulting in forms of life wholly new to the universe.

ULTRA-VIOLET radiation, now widely used for the promotion of human health, has been shown to be able to promote plant growth as well, and to increase the production of valuable plant ingredients. Experiments in this field were reported before the Botanical Society of America by Adelia McCrea, of Parke, Davis and Company, Detroit. Miss McCrea planted two crops of foxglove plants, from which the widely-used drug digitalis is made. Part of each crop was started under ordinary glass, which shuts out ordinary light, and the rest under special glass which transmits ultra-violet. The young plants under the ultra-violet responded at once, forming new leaves faster than the others did. After they were transferred out of doors and grown to maturity under similar conditions, both crops were put through the process for extracting the drug. The irradiated plants yielded an extract of notably higher potency than the untreated controls; in the second crop the increase amounted to as much as 35 per cent.

ULTRA-VIOLET rays can sometimes be too much of a good thing, especially to the lowlier forms of animal life. Some of the effects they have were discussed by Professor E. E. Just, of Howard University. Eggs of Nereis, a sea worm, were exposed to ultra-violet rays by Professor Just. Normally the eggs of this animal possess 28 chromosomes, or bearers of hereditary qualities. After irradiation they were found to have 70. Since multiplication of these important bodies in any living organism is apt to be followed by the development of freak forms in the adult stage this discovery may come to have considerable importance in genetics. The rays have other effects on the eggs also. They lose a jelly-like substance on raying. When they begin to undergo cell division, the first partition always starts from the spot where the rays hit their covering membranes, and the young worms usually show certain localized defects traceable to their experience while in the one-cell stage. Professor Just and his students also presented papers on the fertilization of eggs of Arbacia, another lowly sea animal, in water containing potassium cyanide, and demonstrated the presence in ordinary mayonnaise dressing of structures usually claimed to be present only in living protoplasm, and thought to be of importance in life processes.

ULTRA-VIOLET light has the power to kill as well as cure. Experiments were reported by Professor A. Brooker Klugh, of Queen's University, Kingston, Canada, showing that the short length ultra-violet radiations of the sun are deadly to the minute crustacea that furnish food for the fish of commerce. For many years biologists have puzzled over the question why these tiny relatives of crabs and lobsters remained at a depth of 90 feet or more under the sea during the day and came to the surface only by night. A long series of experiments conducted at the Atlantic Biological Station, St. Andrews, New Brunswick, during the past summer has demonstrated that this particular form of food for the fishes is really fatally affected by ultra-violet light. Consequently they keep down at a considerable depth below the surface of the sea while the light from the sun is intense.

WHILE the biologists attending the meeting were listening to accounts of newly-discovered ways in which X-rays affect living tissue, the physicists heard about another new property of these rays. Dr. Fred Allison, of the Ala-

bama Polytechnic Institute at Auburn, told the American Physical Society how he had found that they change the effect of certain liquids and other substances on light. Many liquids, such as a sugar solution, have the property of turning the plane of polarized light. Ordinary light consists of vibration in an indefinite number of directions, but when polarized, the vibration is confined to one particular plane. If a beam of such light is passed through a sugar solution, it is still vibrating in one direction when it emerges, but in a different direction from that when it went in. Dr. Allison has found that even liquids which do not ordinarily have this power gain it when exposed to X-rays. When liquids, or glass, are placed in the field of a powerful magnet, they gain this property, as discovered many years ago by Faraday. When X-rays are used in addition, says Dr. Allison, the rotatory powers of the liquids are increased, while in glass, it is made to rotate in the opposite direction.

ANOTHER newly-discovered effect of X-rays, by which they impart on certain chemical substances the power of glowing when slightly heated, was described to the meeting of the American Physical Society by Dr. Frances G. Wick, of Vassar College. Dr. Wick told of work that she had done in collaboration with Miss Mabel K. Slattery, research assistant at Cornell University. Some substances, such as fluorite and calcite, have long been known to possess the property of shining in the dark after being moderately warmed, she stated. However, the investigators have found that chemicals which do not have this power acquire it when exposed to X-rays. One of these is calcium sulphate, of which gypsum is a form, mixed with a little manganese. The phenomenon is called thermoluminescence, and is of two kinds. One dies out quickly, but with the other, the power to glow when heated may continue for months.

HOW a thin layer of atoms of caesium on the filament helps the vacuum tube of a radio set to work better was described by Dr. J. A. Becker, of the Bell Telephone Laboratories in New York. Dr. Becker told of work that he had done in collaboration with D. W. Mueller, of the same laboratories. The operation of a radio tube, he explained, depends on the copious emission of electrons from the hot filament. When coated with caesium, in the form of caesium oxide, the atoms of the metal arrange themselves over the filament in a single layer. But the atoms are ionized, which means that each of them has lost one of its quota of electrons, and so is positively charged. This atomic layer is then able to act in the same way as the grid of the tube, but being so close to the filament is particularly efficacious in pulling the electrons out of the tungsten of which it is made.

THE path traced by a moving spot of light in a special vacuum tube reveals the quality of a quartz crystal to be used in keeping broadcasting stations on a constant wave-length At the meeting of the American Physical Society Dr. Karl S. Van Dyke, of Wesleyan University, told of his researches which may play a useful part in the production of these important crystals. These piezo-electric crystals, as they are called, usually consist of plates of quartz, cut from larger quartz crystals. At present, it is usually necessary to try several of them in order to find a satisfactory one, as a large number may not work at all. Some may be considerably improved with a little grinding. With the use of the cathode ray oscillograph, as the special vacuum tube is called, a stream of electrons, or cathode rays, falls on a screen, where it makes a spot of light. The motion of the stream of electrons causes the spot to trace a curve, and quick inspection of this curve reveals the quality of the crystal.

VITAMIN A, the substance needed for normal growth and health, is present in green vegetables, but the much-sought-after blanched garden products do not have it. This has been proved to be true in the case of asparagus, at least, by Dr. John W. Crist and Dr. Marie Dye, of Michigan State College, who reported their experiments before a session of the American Association. Young white rats were fed on a diet lacking in the growth-promoting vitamin. Some of them were given, as a supplementary ration, a small amount of green asparagus tips every day, while a second lot of rats, as "controls," were fed on blanched tips. The asparagus was fed both fresh and cooked. In all cases the animals receiving the green asparagus grew and throve normally, while the ones on the blanched tip diet dwindled and died. Even doubling the amount of blanched asparagus fed to one of the rat groups failed to save them.

FISH blood has its sugar radically reduced by the diabetes-curing drug, and if only the normal concentration of sugar is present the fish goes into convulsions, just as a man or a warm-blooded animal would, and may die as a result, unless a counteracting dose of glucose is injected after the insulin. These results of researches on the blood-sugar physiology of fishes were reported by Dr. Irving E. Gray, of Tulane University. Only one species of fish, the puffer, resisted the action of the insulin and did not go into convulsions. This fish normally has a very low concentration of sugar in its blood.

THERE has been a marked decrease in the incidence of hookworm in the states of North and South Carolina in recent years according to Dr. W. G. Gamble, of Charleston. After reading some of the early surveys of hookworm infestation in the southern states, especially in the Sand-Hill regions and Coastal Plains in the Carolinas, Dr. Gamble said, one wonders what the inhabitants did except to raise razorback hogs, hookworms and drink moonshine. Some of the figures for the period from 1910 to 1915 gave as high as 50 per cent. infection. In the period from 1920 to 1923 the rate was much less. Recent surveys made by Dr. Gamble and the Hygienic Laboratory at Columbus, S. C., show 17.8 and 21.8 per cent., respectively, for infestation with all intestinal parasites, a marked decrease from years ago. Hookworms still lead the list, with round worms, a poor second. Children, women, men, white and colored in the order named, showed the greatest percentage of infection.